

Stability analysis of unsteady three-dimensional viscous flow over a permeable stretching/shrinking surface

ABSTRACT

In this paper, a theoretical and numerical study on the unsteady three-dimensional boundary layer flow of a viscous fluid past a permeable stretching/shrinking sheet is considered. Similarity transformation is used to reduce the governing system of nonlinear partial differential equations into a system of ordinary differential equations. These equations are then solved numerically by using the `ode45` function in MATLAB. The effects of the governing parameters, namely the unsteadiness parameter, the stretching/shrinking parameter, the suction parameter and the ratio of the surface velocity gradients on the skin friction coefficients, as well as the velocity profiles are presented and discussed. Multiple solutions are found for a certain range of the governing parameters. Stability analysis has been performed to determine which solution is stable and physically realisable.

Keyword: Boundary layer; Dual solutions; Stability analysis; Stretching/shrinking sheet; Three-dimensional unsteady flow